

COURSE TITLE

Discover, Dissect, and Delve into Science

LENGTH

One Semester

DEPARTMENT

STEM Department

SCHOOL

Union Middle School

DATE

September 10, 2018

Discover, Dissect, and Delve into Science

I. Introduction/Overview/Philosophy

Anytime can be a fun time to explore science. In this elective, students will leave their science reservations behind and prepare themselves to participate in interactive activities, demonstrations, and projects designed to help them to better understand the world.

II. Objectives

Course Outline:

1. Introduction to Scientific Discovery & Engineering Design (STEAM)
 - a. Density exploration
 - b. Sink or float activity
 - c. Engineering (foil boats)
 - d. Forces of flight
 - e. Engineering (paper airplanes)
2. Pathogens/Disease
 - a. Pathogens/genetic mutations
 - b. Spreading of disease
 - c. Stop that germ/epidemic activity
 - d. Grow and analyze bacteria colonies
 - e. Disease awareness project
3. Natural Disasters
 - a. Exploring disasters
 - b. Disaster preparedness activity
 - c. Mapping natural hazards/disasters
 - d. Engineering (earthquake proof structures)
 - e. Explore the effects human activities on climate change
 - f. Stop Disasters game
4. Adaptations
 - a. Types of adaptations
 - b. Species adapting due to climate change exploration/research project
 - c. Adaptation matching game
 - d. Feather features activity
5. Exploration of body systems through dissection
 - a. Explore how the body is a system of multiple interacting subsystems and explain how these systems work together to perform specific body functions including:
 - i. Circulatory
 - ii. Excretory
 - iii. Digestive
 - iv. Respiratory
 - v. Muscular

- vi. Nervous
- b. Dissection of organisms can include:
 - i. Grasshopper
 - ii. Cow eye
 - iii. Mussel
 - iv. Frog
 - v. Rat
6. Human Body Systems/Functions
 - a. Creation of human body models (i.e. lung)
 - b. Reactions/brain activity
 - c. Digestive system experiments
 - d. Blood typing activity

Student Outcomes:

After successfully completing this course, the student will:

- Analyze, collect, organize and interpret data to create empirically based arguments.
- Construct, communicate, and interpret experimental findings with others.
- Gather and synthesize information as well as identify scientific questions to make predictions.
- Evaluate the strengths and weakness of data, claims, and arguments.
- Discuss, relate and associate scientific terminology, concepts, principles and theories and relate to investigations, discussions and activities.
- Develop the skill to utilize methods and processes to solve problems using scientific reasoning.
- Create models to describe relations and relate to differing functions.
- Use oral and written arguments to support scientific reasoning.
- Collaborate, share and work in groups in order to improve understanding of scientific concepts.

New Jersey Student Learning Standards***CAREER READY PRACTICES******CRP1 Act as a responsible and contributing citizen and employee.***

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2 Apply appropriate academic and technical skills.

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation

CRP4 Communicate clearly and effectively and with reason.

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and

organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.

Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP11. Use technology to enhance productivity.

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

CRP12. Work productively in teams while using cultural global competence.

Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

TECHNOLOGY

Standard 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate

knowledge.

Strand A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.

8.1.8.A.3- Use and/or develop a simulation that provides an environment to solve a real world problem or theory.

Strand E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

8.1.8.E.1- Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

Strand F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

8.1.8.F.1- Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision.

Standard 8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:

All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Strand C. Design: The design process is a systematic approach to solving problems.

8.2.8.C.1- Explain how different teams/groups can contribute to the overall design of a product.

8.2.8.C.2- Explain the need for optimization in a design process.

8.2.8.C.3- Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.

8.2.8.C.4- Identify the steps in the design process that would be used to solve a designated problem.

Strand D. Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

8.2.8.D.1- Design and create a product that addresses a real world problem using a design process under specific constraints.

8.2.8.D.3- Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.

21ST CENTURY LIFE AND CAREERS

9.2 Career Awareness, Exploration, and Preparation

Strand B: Career Exploration

9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

COMPANION STANDARDS FOR SCIENCE AND TECHNICAL SUBJECTS

RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

RST.6-8.7. Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

WHST.6-8.5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

NEW JERSEY STUDENT LEARNING STANDARDS- SCIENCE

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

MS-LS3-1. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

MS-LS3-2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

III. Proficiency Levels

Discover, Dissect, and Delve into Science is a semester elective course appropriate for all grade 7 and 8 students.

IV. Methods of Assessment

Student Assessment

The teacher will provide a variety of assessments during the course of the year. The assessment may include but is not limited to: group activities, presentations, creation of models, participation, group work, and other teacher-developed methods of assessment.

Curriculum/Teacher Assessment

The teacher will provide the subject area supervisor with suggestions for changes on an ongoing basis.

V. Grouping

This is a middle school elective course offered to students in grade 7 and grade 8.

VI. Articulation/Scope & Sequence/Time Frame

Course length is one semester.

VII. Resources

Texts/Supplemental Reading/References

Resources may include but are not limited to:

1. Preserved Specimens:
 - a. Clam
 - b. Starfish
 - c. Frog
2. Documentaries
3. Textbooks
4. Manuals
5. Outdoor Activities
6. Magazines
7. Newspaper Articles
8. Scientific Journals
9. Media Specialist

VIII. Suggested Activities

Appropriate activities are listed in the curriculum map.

IX. Methodologies

The following methods of instruction are suggested: lecture, group projects, demonstration, hands-on applications, and class presentations.

X. Interdisciplinary Connections

The primary focus of this course is to allow students to connect concepts learned in the regular science classroom to activities and situations in the real world. Applications to math, art, computer science, English/language arts, writing, and social studies will be made on a daily basis through a variety of projects and explorations.

XI. Differentiating Instruction for Students with Special Needs: Students with Disabilities, Students at Risk, English Language Learners, and Gifted & Talented Students

Differentiating instruction is a flexible process that includes the planning and design of instruction, how that instruction is delivered, and how student progress is measured. Teachers recognize that students can learn in

multiple ways as they celebrate students' prior knowledge. By providing appropriately challenging learning, teachers can maximize success for all students.

Differentiating in this course includes but is not limited to:

Differentiation for Support (ELL, Special Education, Students at Risk)

- Peer mentoring on problems
- Differentiated teacher feedback on assignments
- Modeling out problems on whiteboard
- Visual aids as we project problems on whiteboard
- Study guides
- Tiered assignments
- Scaffolding of materials and assignments
- Re-teaching and review
- Guided note taking
- Exemplars of varied performance levels
- Multi-media approach to accommodating various learning styles

Differentiation for Enrichment

- Supplemental reading material for independent study
- Flexible grouping
- Tiered assignments
- Topic selection by interest
- Enhanced expectations for independent study
- Elevated questioning techniques using Webb's Depth of Knowledge matrix

XII. Professional Development

The teacher will continue to improve expertise through participation in a variety of professional development opportunities.

XII. Curriculum Map/Pacing Guide

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
<p>Introduction to Scientific Discovery & Engineering Design (STEAM)</p> <p>Students will plan and conduct scientific investigations focusing on engineering design. They will develop and test models in order to achieve an optimal and successful engineering design</p> <ul style="list-style-type: none"> ● Density exploration ● Sink or float activity ● Engineering (foil boats) ● Forces of flight ● Engineering (paper airplanes) 	2 weeks	<p><i>For Support:</i> Use of prompts, provide both written and oral directions, rephrase questions/directions/ explanations, teacher modeling, assist students in small groups, visual learning and aides, pairing with more advanced students, circulate classroom and monitor that all students are actively engaged, use of visual and multi-sensory formats, provide detailed engineering project design constraints</p> <p><i>For Enhancement:</i> Provide extension activities, adjusting the pace of lessons, student-driven projects, real-world problems and scenarios, critical/analytical thinking tasks, higher order thinking skills</p>	MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4 CRP1,4,7,8,9,10,11 8.1.8.A.3 8.1.8.E.1 8.1.8.F.1 8.2.8.C.1,2,3,4 8.2.8.C.1,3 9.2.8.B.3 RST.6-8.3,7,9 WHST.6-8.5,6,8	<p><i>Formative Assessment:</i> Classwork, monitoring of group work, routine discussion and strategic questioning, self-assessment and reflection, digital journals for note-keeping and assessment of prior knowledge, small group meetings</p> <p><i>Summative Assessment:</i> Project/engineering designs (assessed with rubrics), research and design worksheets, lab reports</p>
<p>Pathogens/Disease</p> <p>Students will identify and describe disease caused by specific pathogens and/or genetic mutations</p> <ul style="list-style-type: none"> ● Pathogens/genetic mutations ● Spreading of disease ● Stop that germ/epidemic activity 	4 weeks	<p><i>For Support:</i> Pre-teaching vocabulary and concepts, use of prompts, provide both written and oral directions, rephrase questions/directions/ explanations, teacher modeling, assist students in small groups, visual learning and aides, pairing with more advanced students, circulate classroom and monitor that all students are actively engaged, use of visual and multi-sensory formats</p>	MS-LS3-1 MS-LS3-2 CRP1,4,7,8,9,10,11 8.1.8.A.3 8.1.8.E.1 8.1.8.F.1 8.2.8.C.1,2,3,4 8.2.8.C.1,3 9.2.8.B.3 RST.6-8.3,7,9	<p><i>Formative Assessment:</i> Classwork, monitoring of group work, routine discussion and strategic questioning, self-assessment and reflection, digital journals for note-keeping and assessment of prior knowledge, small group meetings, online</p>

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
<ul style="list-style-type: none"> ● Grow and analyze bacteria colonies ● Disease awareness project 		<p><i>For Enhancement:</i> Provide extension activities, adjusting the pace of lessons, student-driven projects, real-world problems and scenarios, critical/analytical thinking tasks</p>	WHST.6-8.5,6,8	<p>simulations, and review games</p> <p><i>Summative Assessment:</i> Final disease awareness project (brochure/slideshow/poster assessed with rubric), research worksheets, lab reports</p>
<p>Natural Disasters Examine the effects of natural disasters on the environment, as well as how human impact on the environment may affect natural disasters</p> <ul style="list-style-type: none"> ● Exploring disasters ● Disaster preparedness activity ● Mapping natural hazards/disasters ● Engineering (earthquake proof structures) ● Explore the effects human activities on climate change ● Stop Disasters game 	3 weeks	<p><i>For Support:</i> Pre-teaching vocabulary and concepts, use of prompts, provide both written and oral directions, rephrase questions/directions/ explanations, teacher modeling, visual learning and aides, circulate classroom and monitor that all students are actively engaged, use of visual and multi-sensory formats</p> <p><i>For Enhancement:</i> Provide extension activities, adjusting the pace of lessons, student-driven projects, real-world problems and scenarios, critical/analytical thinking tasks</p>	MS-ESS3-2 MS-ESS3-5 MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4 CRP1,4,7,8,9,10,11 8.1.8.A.3 8.1.8.E.1 8.1.8.F.1 8.2.8.C.1,2,3,4 8.2.8.C.1,3 9.2.8.B.3 RST.6-8.3,7,9 WHST.6-8.5,6,8	<p><i>Formative Assessment:</i> Classwork, monitoring of group work, routine discussion and strategic questioning, self-assessment and reflection, digital journals for note-keeping and assessment of prior knowledge, small group meetings, simulations and review games</p> <p><i>Summative Assessment:</i> Natural disaster research project, labs, earthquake-proof structure engineering design (assessed with rubric)</p>
<p>Adaptations</p> <ul style="list-style-type: none"> ● Types of adaptations ● Species adapting due to climate change exploration/research project 	3 weeks	<p><i>For Support:</i> Pre-teaching vocabulary and concepts, use of prompts, provide both written and oral directions, rephrase questions/directions/</p>	MS-LS1-4 MS-LS1-5 MS-LS4-4 MS-LS4-6	<p><i>Formative Assessment:</i> Classwork, monitoring of group work, routine discussion and strategic</p>

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
<ul style="list-style-type: none"> ● Adaptation matching game ● Feather features activity 		<p>explanations, teacher modeling, assist students in small groups, visual learning and aides, pairing with more advanced students, circulate classroom and monitor that all students are actively engaged, use of visual and multi-sensory formats</p> <p><i>For Enhancement:</i> Provide extension activities, adjusting the pace of lessons, student-driven projects, real-world problems and scenarios, critical/analytical thinking tasks, higher order thinking skills</p>	CRP1,4,7,8,9,10,11 8.1.8.A.3 8.1.8.E.1 8.1.8.F.1 8.2.8.C.1,2,3,4 8.2.8.C.1,3 9.2.8.B.3 RST.6-8.3,7,9 WHST.6-8.5,6,8	<p>questioning, self assessment and reflection, digital journals for note-keeping and assessment of prior knowledge, small group meetings, review games</p> <p><i>Summative Assessment:</i> Adaptation research project (assessed with rubric), activity worksheets, lab reports</p>
<p>Exploration of body systems through dissection</p> <ul style="list-style-type: none"> ● Explore how the body is a system of multiple interacting subsystems and explain how these systems work together to perform specific body functions including: <ul style="list-style-type: none"> ○ Circulatory ○ Excretory ○ Digestive ○ Respiratory ○ Muscular ○ Nervous ● Dissection of organisms can include: <ul style="list-style-type: none"> ○ Grasshopper ○ Cow eye ○ Mussel ○ Frog ○ Rat 	4 weeks	<p><i>For Support:</i> Pre-teaching vocabulary and concepts, use of prompts, provide both written and oral directions, rephrase questions/directions/ explanations, teacher modeling, visual learning and aides, circulate classroom and monitor that all students are actively engaged, use of visual and multi-sensory formats</p> <p><i>For Enhancement:</i> Provide extension activities, adjusting the pace of lessons, higher-order thinking skills</p>	MS-LS1-3 CRP1,4,7,8,9,10,11 8.1.8.A.3 8.1.8.E.1 8.1.8.F.1 8.2.8.C.1,2,3,4 8.2.8.C.1,3 9.2.8.B.3 RST.6-8.3,7,9 WHST.6-8.5,6,8	<p><i>Formative Assessment:</i> Classwork, monitoring of group work, routine discussion and strategic questioning, self-assessment and reflection, digital journals for note-keeping and assessment of prior knowledge, small group meetings, online dissection simulations, review games</p> <p><i>Summative Assessment:</i> Dissections, pre-dissection lab research and post-dissection lab reports</p>

Unit Topic	Time Allocated	Differentiating Instruction for Students with Disabilities, Students at Risk, English Language Learners, & Gifted & Talented Students	Standards	Assessments
<p>Human Body Systems/Functions</p> <ul style="list-style-type: none"> ● Creation of human body models (ie lung) ● Reactions/brain activity ● Digestive system experiments ● Blood typing activity 	4 weeks	<p><i>For Support:</i> Use of prompts, provide both written and oral directions, rephrase questions/directions/ explanations, teacher modeling, assist students in small groups, visual learning and aides, pairing with more advanced students, circulate classroom and monitor that all students are actively engaged, use of visual and multi-sensory formats</p> <p><i>For Enhancement:</i> Provide extension activities, adjusting the pace of lessons, student-driven projects, real-world problems and scenarios, critical/analytical thinking tasks, higher order thinking skills</p>	MS-LS1-3 MS-LS1-8 CRP1,4,7,8,9,10,11 8.1.8.A.3 8.1.8.E.1 8.1.8.F.1 8.2.8.C.1,2,3,4 8.2.8.C.1,3 9.2.8.B.3 RST.6-8.3,7,9 WHST.6-8.5,6,8	<p><i>Formative Assessment:</i> Classwork, monitoring of group work, routine discussion and strategic questioning, self-assessment and reflection, digital journals for note-keeping and assessment of prior knowledge, small group meetings, online body system simulations, review games</p> <p><i>Summative Assessment:</i> Creation of models, activity research sheets, lab reports</p>